Tag	Attributes	Text	Description
<cli>	·	·	Contains zero or more modes
<mode>	name	·	Contains zero or more command tags. Attribute is required.
<command>	·	·	Contains a required keyword tag.
<keyword>	text	·	Contains zero or more keyword tags. with an optional action or help tag. Attribute is required.
<help>	·	Yes	May be embedded in keyword or arg elements.
<action>	object method	·	Contains zero or more arg tags. The attributes are required.
<arg>	·	·	Contains a single instance of type tag, may contain a help tag.
<type>	Type	·	Empty tag. Attribute is required, must be a valid java type.

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FIGURE 1

200

```
Command> show clock
    14:10:13 400 UTC Thu May 6 1993
```

205

```
Command> show clock detail
    14:10:13.409 UTC Thu May 6 1993
    Time source is user configuration
```

210

```
<?xml version="1.0" encoding="US-ASCII"?>
<!DOCTYPE cli SYSTEM "cli.dtd">
<cli>
<mode name="global">
....
<command>
    <keyword text="show">
    <help>Show running system information</help>
.... <!-lots of other show keywords... -->

        <keyword text="clock">
            <?help>display the system clock</help>         212
            <action object="Clock" method="show">
            </action>

            <keyword text="detail">
                <help>Display detailed information </help>
                action object="Clock" method="showDetail">
                </action>                                      215
            </keyword>
        </keyword>
    </keyword>
</command>
</mode>
</cli>
```

FIGURE 2

321 ~ Command   clock set
hh:mm:ss Current Time

322 ~ Command > clock set 00:00:00
<1-31> Day of the month
MONTH Month of the year

323 ~ Command > clock set 00:00:00 15 Sep
<1993-2035> Year

324 ~ Command > clock set 00:00:00 25 Sep 2000

Command >

325 ~
```
<command>
    <keyword text="clock">                ~ 327
        <help>Manage the System clock</help>
        <keyword text="set">  ~ 328
            <help> Set the time and date</help>
            <action object="Clock" method="set"> ~ 329
                <arg> <!-time argument -->
                    <type type="java.land.String"></type>
                    <help>hh:mm:ss Current Time </help> ~ 330
                </arg>
                <arg> <!-day of the month argument -->
                    <type type="java.lang.Integer"></type>
                    <help>&lt;1-31&gt; Day of the month</help> ~ 335
                </arg>
                <arg> <!-day of the month argument -->
                    <type type="java.lang.Integer"></type>
                    <help>MONTH Month of the year </help> ~ 340
                </arg>
                <arg> <!-year argument -->
                    <type type="java.lang.Integer"></type>
                    <help>&lt;1993-2035&gt; Year</help> ~ 345
                </arg>
            </action>
        </keyword>
    </keyword>
</command>
```

FIGURE 3

```
<?xml version='1.0' encoding='us-ascii"?>
<!—DTD for the cli description file -->

        <!—The cli tag is the topmost element. Contains zero or more modes. -->
<!ELEMENT cli (mode*)>

        <!--The mode tag contains zero or more command tags. The mode must
        have a name, for example "global", "exec", "config" -->
<!ELEMENT mode (command*)>
<!ATTLIST mode
        name CDATA #REQUIRED
>


        <!—The command tag contains a single keyword -->
<!ELEMENT command (keyword)>

        <!--The keyword tag contains zero or more subkeywords, with an optional
        single instance of action or help. The single attribute is the keyword test
        which must be present -->
<!ELEMENT keyword ((keyword)*, action?, help?)>
<!ATTLIST keyword
        test CDATA #REQUIRED
>


        <!-- The action tag contains zero or more argument tags. The "object"
                    and "method" attributes must be present and defined"
<!ELEMENT action (arg*)>
<!ATTLIST action
        object CDATA #REQUIRED
        method CDATA #REQUIRED
>


        <!-- The arg tag contains a single instance of a type tag and an
        optional help tag -->
<!ELEMENT arg (type, help?)>

        <!-- The type tag is an empty tag with a required attribute "type". The
        value of the attribute should be a Java class name -->
<!ELEMENT type EMPTY>
<!ATTLIST arg
        type CDATA #REQUIRED
>

        <! -- The help tag enloses some text -->
<!ELEMENT help (#PCDATA)>
```

FIGURE 4

FIGURE 5

```
<Command>
  <keyword text="show">
    <help>Show running system information</help>
    ...
      <keyword text="clock">
        <help>Display the system clock</help>
        ...
      </keyword>
  </keyword>
```

keyword = "show"
help = "Show...
parent
substates = ( )

615

keyword = "clock"
help = "Display...
parent
substates = ( )

620

605

610

600

FIG. 6

```
<keyword text="FastEthernet">
  <help>FastEthernet IEEE 802.3</help>
  <action object="ethManager" method="show">
    <arg>
      <type type="java.lang.String"><type>
      <help>
        &lt;0-6&gt;: FastEthernet interface number
      </help>
    </arg>
  </action>
</keyword>
```
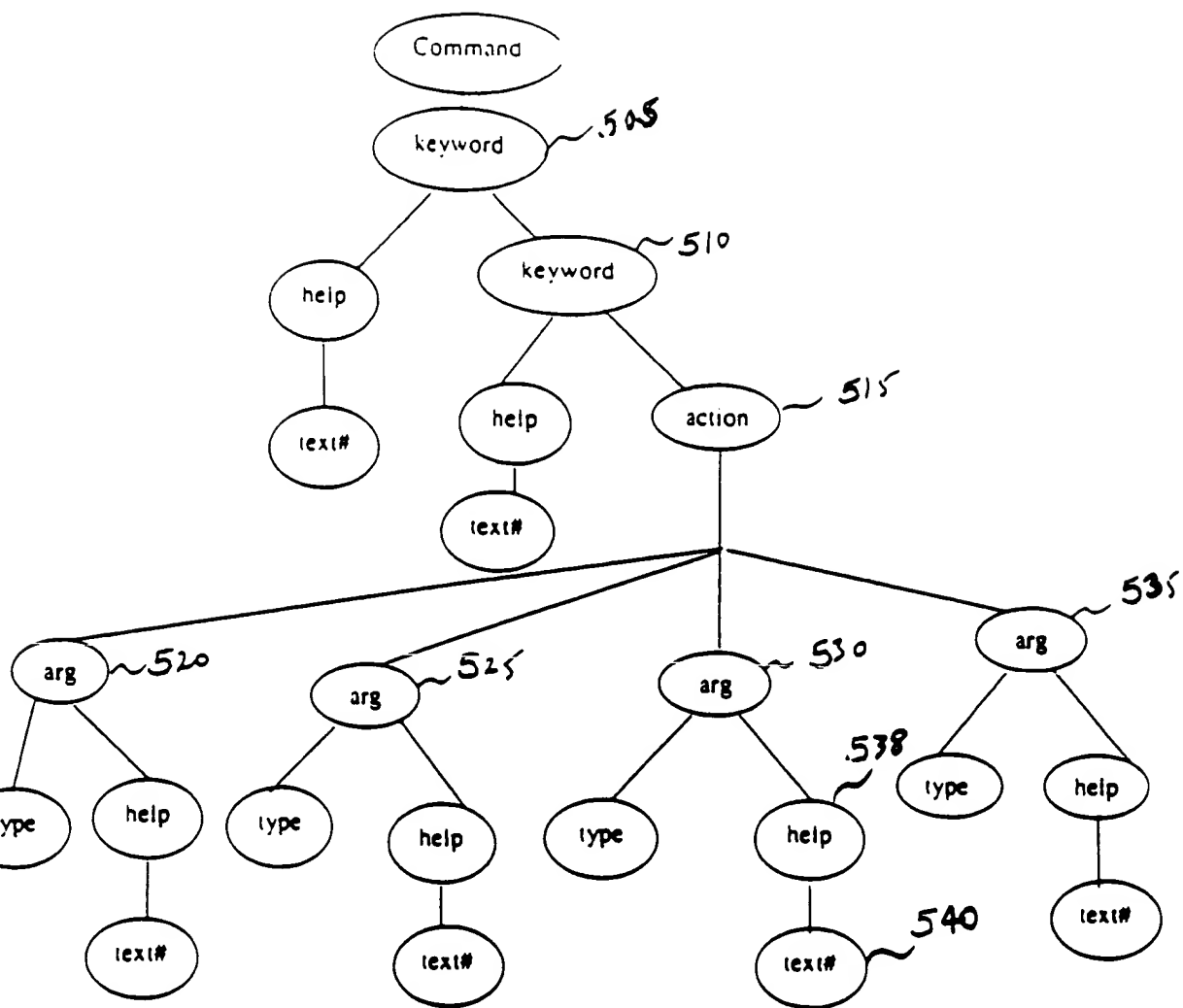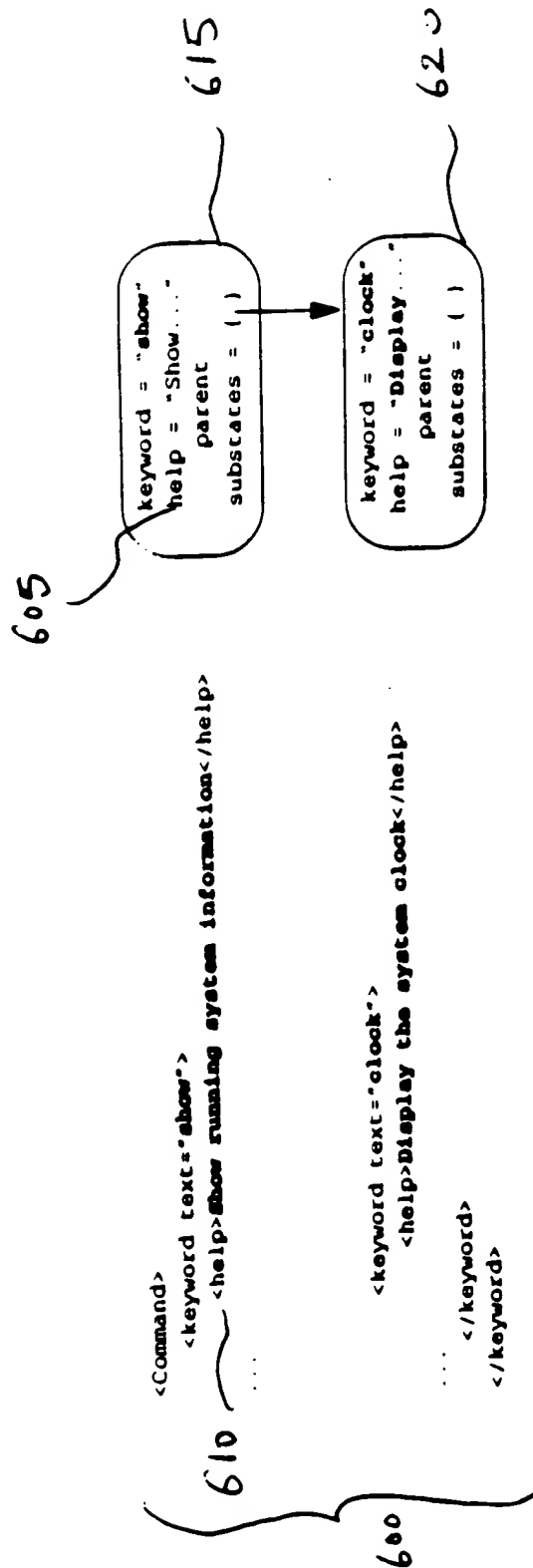
700

710
```
keyword : "FastEthernet"
help = "Fast...."
     parent
substates = ( )
     action
```

712

720
```
object_name = "ethManager"
method_name = "show"
argument_types = ("java.lang.String")
argument_help = ("<0-6> Fast....")
```

714
716
718

FIG. 7
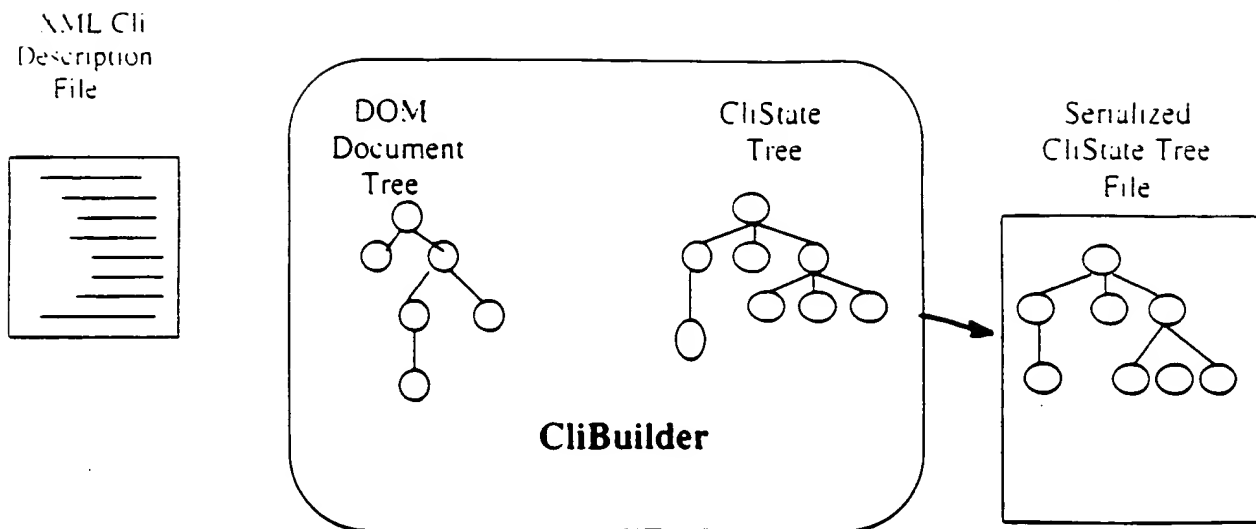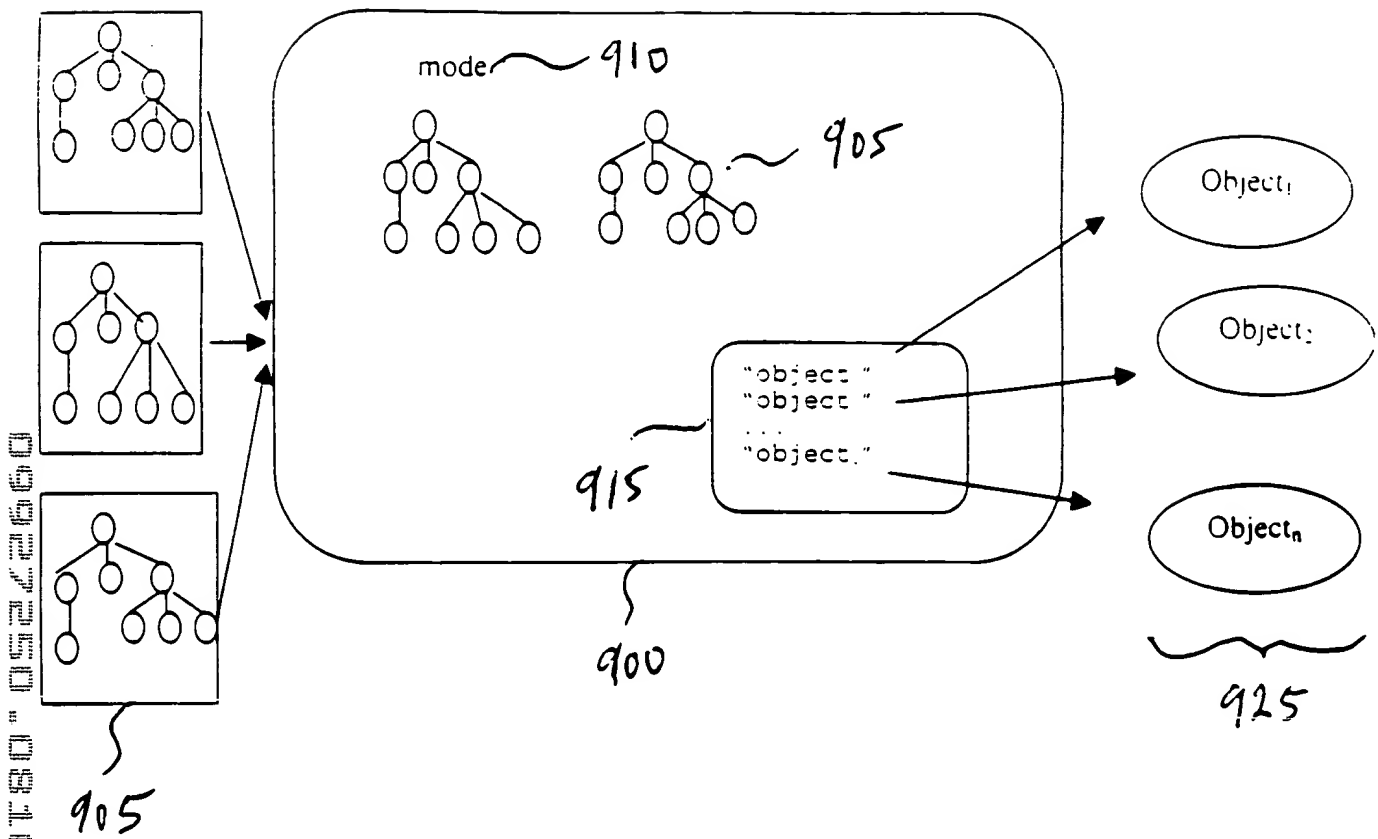
XML Cli
Description
File

DOM
Document
Tree

CliState
Tree

Serialized
CliState Tree
File

CliBuilder

FIGURE 8

FIGURE 9

show ~ 1005

clock ~ 1010

detail ~ 1015

1000

FIGURE 10

show
clock
detail

show clock detail

1105

transition ("show")

show
clock
detail

show clock detail

1110

transition ("clock")

show
clock
detail

show **clock** detail

1115

transition ("detail")

show
clock
detail

show clock **detail**

1120

FIGURE 11

FIGURE 12

```
        ( Start )  ~ 1200
            |
            v
    +----------------+
    |     Define     |  ~ 1205
    |    Commands    |
    +----------------+
            |
            v
    +----------------+
    |     Design     |  ~ 1210
    |    Platform    |
    |   Interfaces   |
    +----------------+
            |
            v
    +----------------+
    |     Create     |  ~ 1215
    |    XML CLI     |
    |  Description   |
    |     Files      |
    +----------------+
            |
            v
    +----------------+
    |     Build      |  ~ 1220
    |   .CLI files   |
    |    and test    |
    +----------------+
            |
            v
        ( Stop )  ~ 1225
```
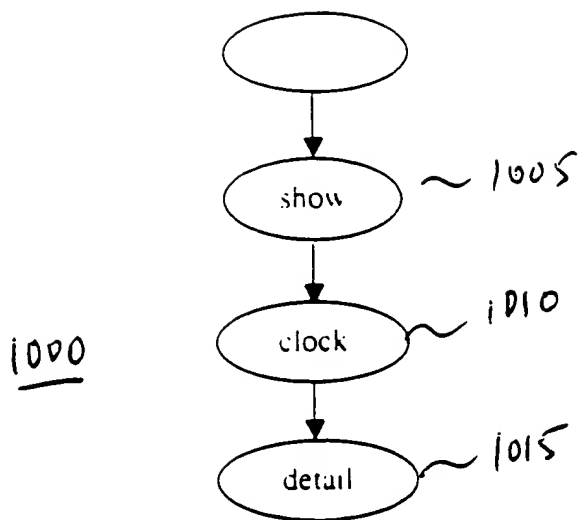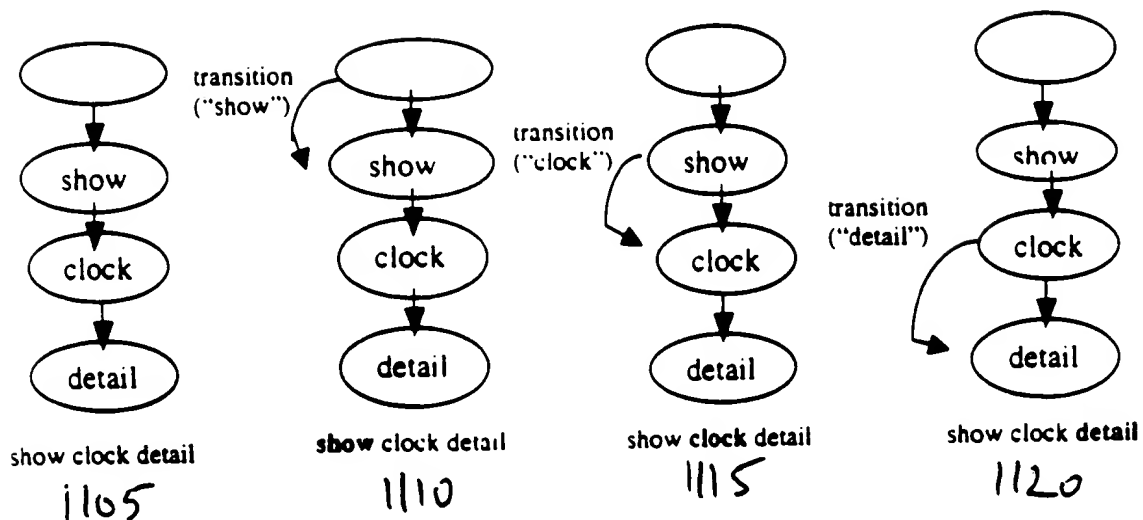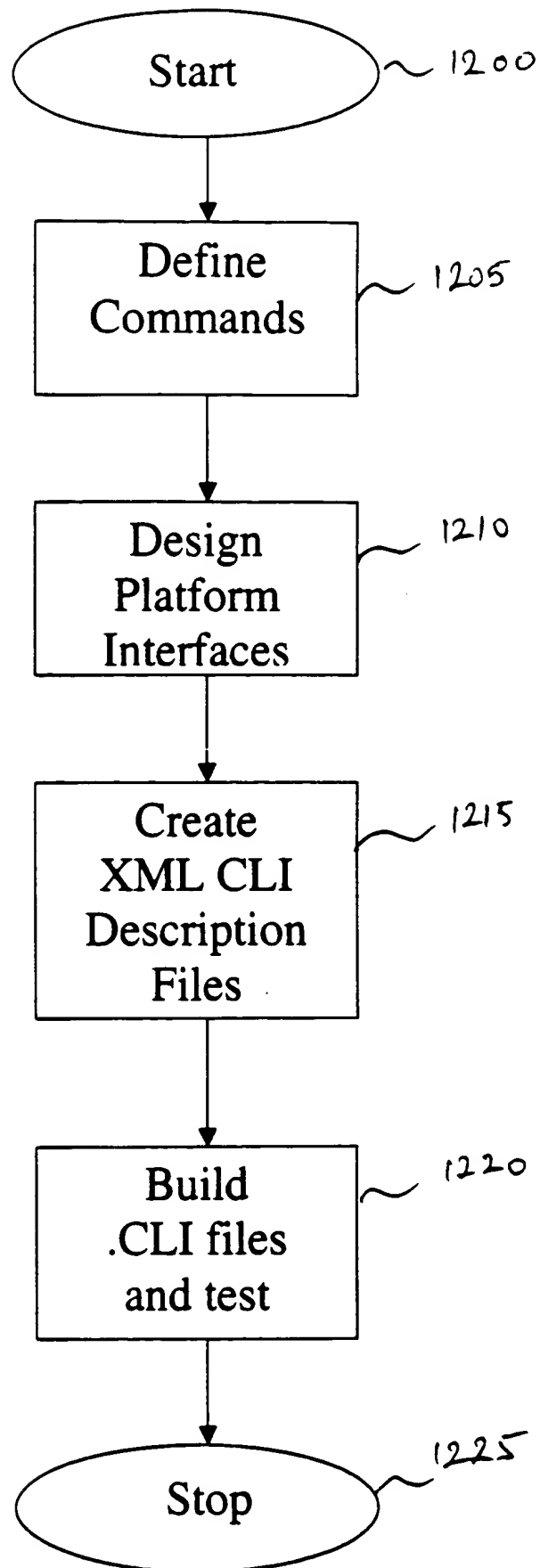
Command	Keyword Set
show date	{"show", "date"}
show date detail	{"show", "date", "detail"}
clock set	{"clock", "set"}

1305   1310

FIGURE 13

Argument Number	Argument Description	Argument Help
1	Time in 00:00:00 format	hh:mm:ss Current Time
2	day of the month in integer format	<1-31> Day of the month
3	month in three letter format	MONTH Month of the Year
4	Year in integer format	<1993-2035> Year

FIGURE 14

Command Keyword Sequence	Help
show	Show running system Information
clock	Manage the system clock
show clock	Display the system clock
show clock detail	Display detailed information
clock set	Set the time and date

FIGURE 15

Argument Number	Argument Description	Java Type
1	Time in 00:00:00 format	java.lang.String
2	day of month integer format	java.lang.Integer
3	Month in three letter format	java.lang.String
4	Year in integer format	java.lang.Integer

1605 1610 1615 1620

FIGURE 16

```
<?xml version='1.0 encoding='US-ASCII' ?>
<! DOCTYPE cli SYSTEM "cli.dtd">
<cli>
<mode name="exec">

<command>
      <keyword text="show">
      <help>Show running system information</help>
      .... <!--lots of other show keywords... -->

                  <keyword text="clock'>
                  </help>Display the system clock </help>
                  <action object="Clock" method= "show">
                  </action>

                  <keyword text="detail">
                  <help>Display detailed information</help>
                  action object="Clock" method="showDetail">
                  </action>
                  </keyword>
      </keyword>
</command>
```

FIGURE 17

```
<command>
        <keyword text="clock"
        <help>Manage the System clock</help>

            <keyword test="set">
            <help> Set the time and date</help>
            <action object="Clock" method="set">

                    <arg><!-- time argument -->
                    <type type="Java.land.String"></type>
                    <help>hh:mm:ss Current time</help>
                    </arg>


                    <arg> <! -- day of the month argument -->
                    <type type="Java.land.Integer"></type>
                    <help>&lt;1-31&gt; day of the month</help>
                    </arg>


                    <arg> <! -- day of the month argument -->
                    <type type="Java.land.Integer"></type>
                    <help>MONTH Month of the year</help>
                    </arg>


                    <arg> <! -- year argument -->
                    <type type="Java.land.Integer"></type>
                    <help>&lt;1993-2035&gt; Year</help>
                     </arg>

        </action>
        </keyword>
    </keyword>
</command>
```

FIGURE 18

```
public void show ()  {
    SimpleDateFormat formatter =
        new SimapleDateFormat ("hh:mm:ss.SSS zzz EEE
MMM dd yyyy");
    System.out.println("*" + formatter.format
(new Date()));
}

public void showDetail () {
    this.show();
    if (Clock.source())
        System.out.println ("Time source is user
configuration");
    else
        System.out.print1n ("No time source");
}
```

FIGURE 19

```java
public void set (String time, Integer day, String month, Integer year)
          throws IOException, InterruptedException, CLIArgumentException
     {
               // Validate the arguments
          SimpleDateFormat format = new SimpleDateFormat ("hh:mm:ss);
          format.setLenient (false);
          try { format parse (time)
          } catch (ParseException e) {
               throw new ArgumentException (1);
          }

          if (day.intValue() < 1 || day.intValue() > 31)
               throw new ArgumentException (2);

          format.applyPattern ("MMM");
          try { format.parse(month);
          } catch (ParseException e) {
               throw new ArgumentException (3);
          }

          if (year.intValue() < 1993 || year.intValue () > 2035
               throw new ArgumentException (4);

          // One last check for day, month and year validity (e.g., Feb 31)
          format.applyPattern ("dd MMM yyy");
          try { format.parse(day.toString() + month + year.toString());
          } catch (parseException e) {
               CLIEngine.out.println("Invalid date (doesn't exist)");
               Return;
          }

          // Do the actual work
     String [] cmd = {"/bin/date", "-s", time + "" + day + " " + month + " " + year
               };
          Process proc = Runtime.getRuntime().exec (cmd);
          proc.waitFor();
          if (proc.exitValue() > 0) {
          CLIEngine.err.println("Operation not permitted");
               return;
          }

          clock.sourceSet();

}
```

FIGURE 20